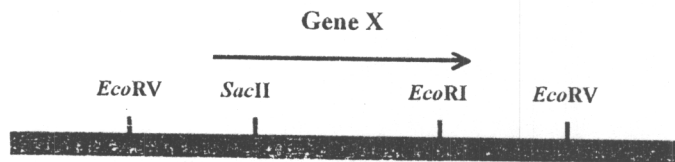
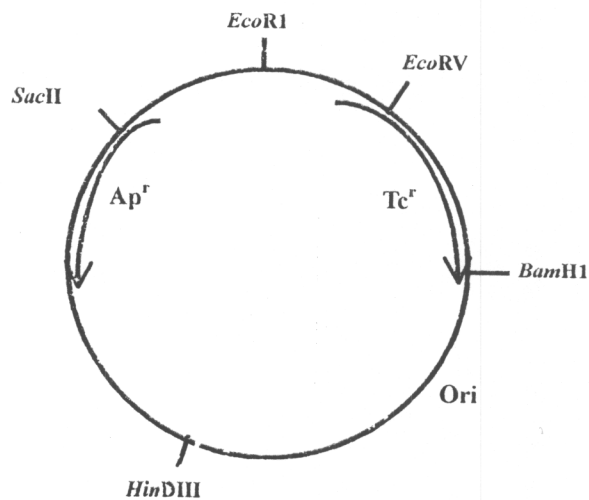


- Describe the transformation experiment with *Streptococcus pneumoniae* that Oswald Avery and his coworkers have reported in 1944 to show that DNA, but not RNA or protein, is the genetic material. (15%)
- Which of the following different types of RNA most likely carry the genetic information? Explain briefly the reason for your decision. (10%)
 - The RNA contained in the ribosomes of a bacterial cell have changed to new ones during infection by a phage.
 - A class of new, unstable RNA found in a phage-infected bacterial cell has a base composition very similar to that of phage genome.
 - A group of small RNA associated with amino acids is found in a bacterial cell only when it is infected by a phage.
- The figure below displays the maps of the gene X to be cloned and the vector to be used. Describe briefly how you would do to clone gene X? How would you screen for clones that contain an insert? (15%)

A. The restriction map of the gene to be cloned



B. The map of the vector



Ori: replication origin; Tc^r: tetracycline-resistance; Ap^r: ampicillin-resistance

4. What conclusions could be drawn from each of the following findings? (15%)
- (1) Mutant embryos of the South Africa clawed frog that lack nucleoli made no rRNA and had no ribosomes; in addition, the amounts of rRNA in *Xenopus* mutants with a varying number of nucleoli depended on the number of nucleoli.
 - (2) When an isolated nucleus was forced to synthesize RNA, it was found that in the presence of Mg^{+2} in low ionic strength solution, most of the transcription occurred in the nucleolus, while in the presence of Mn^{+2} in high ionic strength solution, the transcription occurred throughout the nucleus.
5. Explain concisely the following terms (20%)
- (1) RNA splicing
 - (2) Operon
 - (3) Proteomics
 - (4) Heterochromatin
 - (5) Transposition
6. What DNA damage may result from ultraviolet radiation? How is such DNA damage repaired in a cell? (10%)
7. You are given by your mentor an *E. coli* mutant that has been deleted of a gene that encodes a regulatory protein for gene A, and a wild-type (parent) strain. He asks you to find out whether this regulatory protein is an activator or a repressor. How would you do the experiment to get the answer? (15%)